
सफेद पोर्टलैंड सीमेंट — विशिष्टि
(तीसरा पुनरीक्षण)

White Portland Cement —
Specification
(Third Revision)

ICS 91.100.10

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FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first published as an emergency standard in 1976 and subsequently revised in 1978 and 1989. This revision incorporates the experience gained with the use of this specification and brings the standard in line with the latest developments in this field.

This standard pertains to white Portland cement and covers the requirements such as its manufacture, chemical and physical requirements, packing and marking.

Since the last revision of this standard, a number of amendments were issued from time to time in order to modify various requirements based on experience gained with the use of the standard and the requirements of the users. These amendments have been incorporated in this revision so as to make it more convenient for the users. Further, following are the significant modifications incorporated in this revision:

- a) Provision for use of appropriate performance improvers, to be added during clinker grinding stage, has been included.
- b) Requirement of loss on ignition has been included.
- c) Requirement of maximum chloride content has been included.
- d) Requirement of compressive strength has been revised.
- e) Optional requirement of testing for transverse strength has been included.
- f) Requirement of testing the cement samples at the earliest but not later than 3 months since the receipt of samples for testing, has been included.
- g) Requirement of marking the 'Best before date' of cement has been introduced.

Quantity of cement packed in bags and the tolerance requirements for the quantity of cement packed in bags shall be in accordance with the relevant provisions of the *Standards of Weights and Measures (Packaged Commodities) Rules, 2011* and **C-1.2**. Any modification in these rules in respect of tolerance on quantity of cement would apply automatically to this standard.

This standard contains **12.2.1** which give option to the purchaser and Table 3 Sl No. (v) and **9.2, 9.3, 9.4** and **9.4.3**, which call for agreement between the purchaser and the supplier.

The composition of the Committee responsible for the formulation of this standard is given in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

WHITE PORTLAND CEMENT — SPECIFICATION

(*Third Revision*)

1 SCOPE

This standard covers the manufacture and chemical and physical requirements of white Portland cement.

2 REFERENCES

The standards given in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 4845 shall apply.

4 MANUFACTURE

4.1 White Portland cement shall be manufactured by intimately grinding the Portland cement clinker with appropriate proportion of natural or chemical gypsum so as to produce a cement capable of complying with this standard. No material shall be added after burning, other than gypsum (natural mineral or chemical, *see* Note), water, and not more than a total of 1.0 percent of air-entraining agents or other agents, which have proved not to be harmful and don't have any negative influence on the degree of whiteness of cement. The performance improver(s) may be added at grinding stage; and their limits of addition shall be governed by the provision under **4.1.1**. All such additions may also be done by interblending process by intimately and uniformly blending the individually ground materials so as to produce a cement capable of complying with this standard.

NOTE — Chemical gypsum shall be added provided that the performance requirements of the final product as specified in this standard are met with.

4.1.1 Limestone, dolomite and marble may be added as performance improver either individually or in combination, and the total limit of their addition shall not be more than 8 percent. The performance improver(s) shall be inclusive of 1.0 percent additives as mentioned above and shall meet the following requirements:

- a) CaO + MgO shall not be less than 50 percent by mass of performance improver, when tested as per IS 1760 (Part 3), and
- b) Whiteness shall not be less than 70 percent when tested as per Annex B.

5 CHEMICAL REQUIREMENTS

When tested in accordance with the methods given in IS 4032, white Portland cement, shall comply with the chemical requirements given in Table 1.

6 PHYSICAL REQUIREMENTS

White Portland cement shall comply with the physical requirements given in Table 2.

7 STORAGE

The cement shall be stored in such a manner as to permit easy access for proper inspection and identification, and in a suitable weather-tight building to protect the cement from dampness and to minimize warehouse deterioration (*see also* IS 4082).

8 MANUFACTURER'S CERTIFICATE

8.1 The manufacturer shall satisfy himself that the cement conforms to the requirements of this standard and, if requested, shall furnish a test certificate to this effect to the purchaser or his representative, within ten days of testing of the cement (except for 28 days compressive strength test results, which shall be furnished after completion of the test). The type and percentage addition of performance improver(s) shall also be indicated in the certificate.

9 PACKING

9.1 The cement shall be packed in any of the following bags:

- a) Jute sacking bag conforming to IS 2580,
- b) Multi-wall paper sacks conforming to IS 11761,
- c) Light weight jute conforming to IS 12154,
- d) HDPE/PP woven sacks conforming to IS 11652,
- e) Jute synthetic union bags conforming to IS 12174, or
- f) Any other approved composite bag.

Table 1 Chemical Requirements for White Portland Cement

(Clause 5.1)

| Sl No. (1) | Characteristic (2) | Requirement (3) |
|---------------|---|--------------------|
| i) | Ratio of percentage of lime to percentages of silica, alumina and iron oxide, when calculated by the formula: $\frac{\text{Cao} - 0.7 \text{ SO}_3}{2.8\text{SiO}_2 + 1.2\text{Al}_2\text{O}_3 + 0.65\text{Fe}_2\text{O}_3}$ | 0.66 – 1.02 |
| ii) | Iron oxide, percent by mass, <i>Max</i> | 1.0 |
| iii) | Insoluble residue, percent by mass, <i>Max</i> | 4.0 |
| iv) | Magnesia, percent by mass, <i>Max</i> | 6.0 |
| v) | Total sulphur content calculated as sulphuric anhydride (SO ₃), percent by mass, <i>Max</i> | 3.5 |
| vi) | Loss on ignition, percent by mass, <i>Max</i> | 7.0 |
| vii) | Chloride content, percent by mass, <i>Max</i> | 0.1 |

Table 2 Physical Requirements for White Portland Cement

(Clause 6)

| Sl No. (1) | Characteristic (2) | Requirement (3) | Method of Test, Ref to (4) |
|---------------|--|--------------------------|-------------------------------|
| i) | Fineness, m ² /kg, <i>Min</i> | 225 <i>see</i> Note 2 | IS 4031 (Part 2) |
| ii) | Soundness: | | IS 4031 (Part 3) |
| | a) By Le-Chatelier method, mm, <i>Max</i> | 10 | |
| | b) By autoclave test method, percent, <i>Max</i> | 0.8 } <i>see</i> Note 2 | |
| iii) | Setting time: | | IS 4031 (Part 5) |
| | a) Initial, min, <i>Min</i> | 30 | |
| | b) Final, min, <i>Max</i> | 600 } <i>see</i> Note 3 | |
| iv) | Compressive strength, MPa (<i>see</i> Note 4): | | IS 4031 (Part 6) |
| | a) 72 ± 1 h, <i>Min</i> | 16 | |
| | b) 168 ± 2 h, <i>Min</i> | 22 | |
| | c) 672 ± 4 h, <i>Min</i> | 33 | |
| v) | Transverse strength (optional) | <i>See</i> Notes 4 and 5 | IS 4031 (Part 8) |
| vi) | Degree of whiteness in terms of reflectance of neat cement ring, percent, <i>Min</i> | 70 | Annex B |

NOTES

1 Those industries which require fineness of white Portland cement in terms of residue by dry sieving, tested by the method described in IS 4031 (Part 1), may specify the same additionally while placing order to a manufacturer by mutual agreement.

2 In the event of cements failing to comply with any one or both the requirements of soundness specified in the above table, further tests in respect of each failure shall be made as described in IS 4031 (Part 3), from another portion of the same sample after aeration. The aeration shall be done by spreading out the sample to a depth of 75 mm at a relative humidity of 50 to 80 percent for a total period of 7 days. The expansion of cements so aerated shall be not more than 5 mm and 0.6 percent when tested by Le-Chatelier method and autoclave test respectively.

3 If cement exhibits false set, the ratio of final penetration measured after 5 min of completion of mixing period to the initial penetration measured exactly after 20 s of completion of mixing period, expressed as percent, shall be not less than 50. In the event of cement exhibiting false set, the initial and final setting time of cement when tested by the method described in IS 4031 (Part 5) after breaking the false set, shall conform to the value given in the above table.

4 By agreement between the purchaser and the manufacturer, transverse strength test of plastic mortar in accordance with the method described in IS 4031 (Part 8) may be specified. The permissible values of the transverse strength shall be mutually agreed to between the purchaser and the supplier at the time of placing the order.

5 Notwithstanding the compressive and transverse strength requirements specified as per the above table, the cement shall show a progressive increase in strength from the strength at 72 h.

Bags shall be in good condition at the time of inspection.

9.1.1 The net quantity of cement per bag shall be 50 kg subject to provisions and tolerance given in Annex C.

9.2 The net quantity of cement per bag may also be 25 kg, 10 kg, 5 kg, 2 kg or 1 kg and packed in suitable bags as agreed to between the purchaser and the manufacturer but the bag shall be of the material and quality as given in with **9.1**. The quantity of cement in the bags shall also be subject to tolerances as given in Annex C for 50 kg bags.

9.3 Supplies of cement in drums or in bulk may be made by arrangement between the purchaser and the supplier (manufacturer or stockist).

NOTE — A single bag or container containing 1 000 kg and more net quantity of cement, shall be considered as the bulk supply of cement. Supplies of cement may also be made in intermediate bags/containers, for example, drums of 200 kg, by agreement between the purchaser and the manufacturer.

9.4 When cement is intended for export and if the purchaser so requires, packing of cement may be done in bags or in drums with net quantity of cement per bag or drum as agreed to between the purchaser and the manufacturer.

9.4.1 For this purpose, the permission of the certifying authority shall be obtained in advance for each export order.

9.4.2 The words 'FOR EXPORT' and the net quantity of cement per bag/drum shall be clearly marked in indelible ink on each bag/drum.

9.4.3 The packing material shall be as agreed to between the manufacturer and the purchaser.

9.4.4 The tolerance requirements for the quantity of cement packed in bags/drum shall be as given in **9.2.1** except the net quantity which shall be equal to or more than the quantity in **9.4**.

10 MARKING

10.1 Each bag or drum of cement shall be legibly and indelibly marked with the following:

- a) Manufacturer's name and his registered trade-mark, if any;
- b) The name and designation of the white Portland cement;
- c) Net quantity, in kg;
- d) The words 'Use no Hooks' on the bags;
- e) Batch/control unit number in terms of week, month and year of packing;
- f) Best before date (that is, 3 months from date of packing);
- g) The need for testing of cement more than 3 months old to check conformity before its use, and
- h) Address of the manufacturer; and
- j) Type and percentage of performance improver(s) added, in case of addition of performance improvers.

10.2 Similar information shall be provided in the delivery advices accompanying the shipment of packed or bulk cement and on cement drums (*see 9.3*).

10.3 BIS Certification Marking

The cement may also be marked with the Standard Mark.

10.3.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which a license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

11 SAMPLING

11.1 A sample or samples for testing may be taken by the purchaser or his representative, or by any person appointed to superintend the work for the purpose of which the cement is required or by the latter's representative.

11.1.1 The samples shall be taken within three weeks of the delivery and all the tests shall be commenced within one week of sampling.

11.1.2 When it is not possible to test the samples within one week, the samples shall be packed and stored in air-tight containers and tested at the earliest but not later than 3 months since the receipt of samples for testing.

11.2 In addition to the requirements of **11.1**, the methods and procedure of sampling shall be in accordance with IS 3535.

11.3 The manufacturer or the supplier shall afford every facility, and shall provide all labour and materials for taking and packing the samples for testing the cement and for subsequent identification of cement sampled.

12 TESTS

12.1 The sample or samples of cement for test shall be taken as described in **12** and shall be tested in the manner described in the relevant clauses.

12.2 Independent Testing

12.2.1 If the purchaser or his representative requires

independent tests, the samples shall be taken before or immediately after delivery at the option of the purchaser or his representative, and the tests shall be carried out in accordance with this standard on the written instructions of the purchaser or his representative.

12.2.2 The manufacturer/supplier shall supply, free of charge, the cement required for testing. Unless otherwise specified in the enquiry and order, the cost of the tests shall be borne as follows:

- a) By the manufacturer/supplier, if the results show that the cement does not comply with the requirements of this standard, and
- b) By the purchaser, if the results show that the cement complies with the requirement of this standard.

12.2.3 After a representative sample has been drawn, tests on the sample shall be carried out as expeditiously as possible (*see 11.1.1 and 11.1.2*).

13 REJECTION

13.1 Cement may be rejected, if it does not comply with any of the requirements of this specification.

13.2 Cement remaining in bulk storage at the factory, prior to shipment, for more than six months, or cement in bags, in local storage such as, in the hands of a vendor for more than 3 months after completion of tests, shall be retested before use and shall be rejected, if it fails to conform to any of the requirements of this specification.

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

| <i>IS No.</i> | <i>Title</i> | <i>IS No.</i> | <i>Title</i> |
|--|---|-----------------|---|
| 1760 (Part 3) : 1992 | Methods of chemical analysis of limestone, dolomite and allied materials: Part 3 Determination of iron oxide, alumina, calcium oxide and magnesia (<i>first revision</i>) | (Part 8) : 1988 | Determination of transverse and compressive strength of plastic mortar using prism (<i>first revision</i>) |
| 2580 : 1995 | Textiles — Jute sacking bags for packing cement — Specification (<i>third revision</i>) | 4032 : 1985 | Methods of chemical analysis of hydraulic cement (<i>first revision</i>) |
| 3535 : 1986 | Methods of sampling hydraulic cements (<i>first revision</i>) | 4082 : 1996 | Recommendations on stacking and storage of construction materials and components at site (<i>second revision</i>) |
| 4031 (Part 1) : 1996 (Part 2) : 1999 | Methods of physical tests for hydraulic cement Determination of fineness by specific surface by Blaine airpermeability method (<i>second revision</i>) | 4845 : 1968 | Definitions and terminology relating to hydraulic cement |
| (Part 3) : 1988 | Determination of soundness (<i>first revision</i>) | 4905 : 1968 | Methods for random sampling |
| (Part 5) : 1988 | Determination of initial and final setting times (<i>first revision</i>) | 11652 : 2000 | Specification for high density polyethylene (HDPE)/polypropylene (PP) woven sacks for packing cement (<i>second revision</i>) |
| (Part 6) : 1988 | Determination of compressive strength of hydraulic cement (other than masonry cement) (<i>first revision</i>) | 11761 : 1997 | Specification for multi-wall paper sacks for cement (<i>first revision</i>) |
| | | 12154 : 1987 | Light weight jute bags for packing cement |
| | | 12174 : 1987 | Jute synthetic union bags for packing cement |

ANNEX B*(Table 2)***TEST FOR DEGREE OF WHITENESS OF WHITE PORTLAND CEMENT****B-1 PREPARATION OF SAMPLE**

Heap some quantity of dry neat cement into a mould of the shape of a ring of 30 mm diameter and 3 mm height (or any other mould or the mould supplied with the reflectivity measuring equipment) placed on a clean glass plate and gently press it down with another clean glass plate so that the density of the cement compact is close to that of the standard magnesium oxide blocks mentioned under **B-2**. Lift the ring gently with the compacted cement inside and prepare two such specimens for measuring the degree of whiteness.

B-2 TESTING

Compare the reflectivity of the compact cement surface with standard magnesium oxide blocks of certified reflectivity on absolute scale with the help of a suitable apparatus, for example, a reflectometer or reflectance spectrophotometer.

B-3 REPORTING OF RESULTS

Average reflectance of two specimens shall be reported; the two values should not differ by more than two units.

ANNEX C*(Foreword and Clause 9.1.1)***TOLERANCE REQUIREMENTS FOR THE QUANTITY OF CEMENT PACKED IN BAGS**

C-1 The average of the net quantity of cement packed in bags at the plant in a sample shall be equal to or more than 50 kg. The number of bags in a sample shall be as given below:

| <i>Batch Size</i> | <i>Sample Size</i> |
|-------------------|--------------------|
| 100 - 150 | 20 |
| 151 - 280 | 32 |
| 281 - 500 | 50 |
| 501 - 1 200 | 80 |
| 1 201 - 3 200 | 125 |
| 3 201 and over | 200 |

The bags in a sample shall be selected at random. For methods of random sampling, IS 4905 may be referred to.

C-1.1 The number of bags in a sample showing a minus error greater than 2 percent of the specified net quantity (50 kg) shall be not more than 5 percent of the bags in the sample. Also the minus error in none of such bags in a sample shall exceed 4 percent of the specified net quantity of cement in the bag.

C-1.2 In case of a wagon/truck load of up to 25 tonne, the overall tolerance on net quantity of cement shall be 0 to 0.5 percent.

NOTE — The mass of a jute sacking bag to hold 50 kg of cement is 531 g, the mass of a 6-ply paper bag to hold 50 kg of cement is approximately 400 g, the mass of a light weight jute bag to hold 50 kg of cement is approximately 450 g, the mass of a HDPE/PP woven sack to hold 50 kg of cement is approximately 70 g/71 g respectively, and the mass of a jute synthetic union bag to hold 50 kg of cement is approximately 420 g.

ANNEX C

(Foreword)

COMMITTEE COMPOSITION

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and
SHRI S. ARUN KUMAR
Scientist 'C' (Civ Engg), BIS

Cement, Pozzolana and Cement Additives Subcommittee, CED 2 : 1

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This Indian Standard has been developed from Doc No.: CED 02 (7970).

Amendments Issued Since Publication

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